CLAIMS

What is claimed is:

1. A fuel cell stack (10) for producing electricity from reducing fluid and process oxidant reactant streams, the stack comprising:

   a. a plurality of fuel cells (14), (16), (18) secured adjacent each other to form a reaction portion (20) of the fuel cell stack (10), the plurality of fuel cells (14), (16), (18) including an end cell (12) secured adjacent a first end (24) of the reaction portion (20) of the stack (10);

   b. a current collector (30) secured adjacent the first end (24) and secured in electrical communication with the end cell (12), wherein the current collector (30) has a sensible heat less than a sensible heat of the end cell (12) and an electrical resistivity no greater than 100 micro-ohm centimeters;

   c. an insulator (40) secured adjacent the current collector (30), wherein a thermal conductivity across the insulator (40) is no greater than 0.500 Watts per meter per degree Kelvin, the insulator (40) being secured to the current collector (30) so that a total rate of heat transfer across the insulator (40) from the end cell (12) is no greater than heat generated by the end cell (12); and,

   d. a pressure plate (42) secured adjacent and overlying the insulator (40) and overlying the end cell (12).

2. The fuel cell stack (10) of claim 1, wherein the sensible heat of the current collector (30) is no greater

than fifty percent of the sensible heat of the end cell (12).

3. The fuel cell stack (10) of claim 1, wherein the sensible heat of the current collector (30) is no greater than twenty-five percent of the sensible heat of the end cell (12).

4. The fuel cell stack of claim 1, wherein the insulator (40) has a thermal conductivity of no greater than 0.005 Watts per meter per degree Kelvin.

5. The fuel cell stack (10) of claim 1, wherein the insulator (40) has a thermal conductivity of no greater than 0.010 Watts per meter per degree Kelvin and the insulator has a compressive strength in excess of 350 kilo Pascals.

6. The fuel cell stack (10) of claim 1, wherein the insulator (40) is a vacuum insulation panel with a thermal conductivity of no greater than 0.005 Watts per meter per degree Kelvin and the insulator has a compressive strength in excess of 350 kilo Pascals.

7. The fuel cell stack (10) of claim 1, wherein the insulator (40) has a thickness of less than 20 millimeters.

8. The fuel cell stack (10) of claim 1, wherein the insulator (40) has a thickness of less than 10 millimeters.

9. The fuel cell stack (10) of claim 1, wherein the insulator (40) has a total rate of heat transfer across

the insulator (40) from the end cell (12) that is less than fifty percent of heat generated by the end cell (12).

10. The fuel cell stack (10) of claim 1, wherein the insulator (40) has a total rate of heat transfer across the insulator (40) from the end cell (12) that is less than twenty-five percent of heat generated by the end cell (12).

11. The fuel cell stack (10) of claim 1, wherein the pressure plate (42) is an electrically conductive metal.

12. The fuel cell stack (10) of claim 1, wherein the pressure plate (42) is made of an electrically non-conductive, non-metallic, fiber reinforced composite material.

13. The fuel cell stack (10) of claim 12, wherein the current collector (30) includes a first long-side extension (43) positioned to extend along a first long-side (54A) of the stack (10) and adjacent the electrically non-conductive pressure plate (42), and a second long-side extension (45) positioned to extend along a second long-side (54B) of the stack (10) and adjacent the electrically non-conductive pressure plate (42), a first power take-off (36) secured in electrical communication with the first long-side extension (43), and a second power take-off (38) secured in electrical communication with the second long-side extension (45) to effect electrical flow through the current collector (30) and to the first and second power take-offs (36), (38).

14. The fuel cell stack (10) of claim 1, wherein the current collector (30) is a metal foil.

15. The fuel cell stack (10) of claim 1, wherein the current collector (30) is a metal coating on the insulator (40).

16. The fuel cell stack (10) of claim 1, wherein the current collector (30) is no greater than 1.00 millimeter thick.

17. The fuel cell stack (10) of claim 1, wherein the current collector (30) is no greater than 0.50 millimeter thick.

18. The fuel cell stack (10) of claim 1, wherein the current collector (30) is no greater than 0.25 millimeter thick.

19. The fuel cell stack (10) of claim 1, wherein the current collector (30) has an electrical resistivity no greater than 50 micro-ohm centimeters.

20. The fuel cell stack (10) of claim 1, wherein the current collector (30) has an electrical resistivity no greater than 25 micro-ohm centimeters.

21. The fuel cell stack (10) of claim 1, wherein the current collector (30) is made of a material selected from the group consisting of tin, copper, zinc, nickel, aluminum, gold, silver, alloys thereof, mixtures thereof, and these materials with gold plating.

22. A fuel cell power plant for supplying electricity to and external load, comprising:

a. a fuel cell stack (10) with a reaction portion (20), the reaction portion having and end cell

(12) with a first sensible heat;

b. a current collector (30) secured in electrical communication with the end cell (12), having a second sensible heat that is less than the first sensible heat, and having an electrical resistivity no greater than 100 micro-ohm centimeters;

c. a pressure plate (42) secured to an outer end (41) of the fuel cell stack (10); and,

d. an insulator (40) disposed between the pressure plate (42) and at least a portion of the current collector (30), the insulator having a thermal conductivity no greater than 0.500 Watts per meter degree Kelvin.

23. The fuel cell power plant of claim 22, wherein the external load is an electric drive component of a transportation device.

24. The fuel cell power plant of claim 22, wherein the external load is a stationary device.

25. A method of rapidly warming up an end cell (12) of a fuel cell stack (10) during a start up of the fuel cell stack (10), the fuel cell stack (10) including a plurality of fuel cells (14), (16), (18) secured adjacent to each other to form a reaction portion (20) of the stack (10), including the end cell (12) secured adjacent a first end (24) of the stack (10), the method comprising the steps of:

a. securing a current collector (30) adjacent to the first end (24) and in electrical communication with the end cell (12), the current collector (30) having a sensible heat less than a sensible heat of the end cell (12)

and an electrical resistivity no greater than 100 micro-ohm centimeters;

b. securing an insulator (40) adjacent the current collector (30), the insulator (40) having a thermal conductivity that is no greater than 0.500 Watts per meter per degree Kelvin, the insulator being (40) secured to the current collector (30) so that a total rate of heat transfer across the insulator (40) from the end cell (12) is no greater than heat generated by the end cell (12);

c. securing a pressure plate (42) adjacent and overlying the insulator (40) and overlying the end cell (12); and,

d. then, directing reactant fluids to flow through the fuel cells (12), (14), (16), (18).